2011. The Journal of Arachnology 39:171–173

SHORT COMMUNICATION

An unusually dense population of *Sphodros rufipes* (Mygalomorphae: Atypidae) at the edge of its range on Tuckernuck Island, Massachusetts

Andrew Mckenna-Foster[1,2], **Michael L. Draney**[2] and **Cheryl Beaton**[1]: [1]Maria Mitchell Association, 4 Vestal Street, Nantucket, Massachusetts 02554 USA; [2]University of Wisconsin-Green Bay, Department of Natural and Applied Sciences, 2420 Nicolet Drive, Green Bay, Wisconsin 54311 USA. E-mail: andrew.mckennafoster@gmail.com

Abstract. We counted and measured *Sphodros rufipes* (Latreille 1829) pursewebs in two survey plots on Tuckernuck Island, Massachusetts. Our objectives were to quantify web density, record physical web characteristics and determine the main components of *S. rufipes'* diet. We counted 479 webs in the two plots and report web densities between 0.058 and 0.18 webs/m^2, denser than previously reported populations. Webs were not distributed evenly, and densities ranged from 0 to 0.38 webs/m^2. Aggregation indices suggest that webs are aggregated on a landscape level, but are more evenly distributed at a local level. Contrary to most previously published literature on *S. rufipes,* we noted the predominance of the grass-like sedge, *Carex pensylvanica,* rather than trees, as a web support. Coleopterans and isopods made up 79 percent of the prey parts collected from 56 pursewebs.

Keywords: Purseweb spiders, web density, diet, spatial distribution

Most spiders in the genus *Sphodros* (family Atypidae) build vertical, tube-like webs that extend from below the soil surface to attach to the trunk of a tree or other solid surface (Gertsch and Platnick 1980). The aerial portion of the tube is usually well camouflaged by the spider with soil particles and debris. There are two *Sphodros* species in New England, USA. *Sphodros rufipes* (Latreille 1829) builds a vertical tube of silk and usually attaches it to the base of a deciduous tree (Hardy 2003). Males of this species have completely red legs, whereas females are all black. *Sphodros niger* (Hentz 1842) is a more cryptic species that usually constructs the 'aerial' portion of its web horizontally and, at least on Cape Cod, Massachusetts, underneath pine duff and leaf litter (Edwards & Edwards 1990). Males and females of this species are all black. *Sphodros rufipes* is a southern species reported in the literature as far north as Block Island, Rhode Island, while *S. niger* is a more northern species that occurs as far south as North Carolina and extends into Canada (Gertsch & Platnick 1980).

Most likely due to their cryptic lifestyle, previous researchers have only described attributes and behaviors that can be studied with small numbers of *Sphodros* spiders such as mating, prey capture, web placement, and web-building behaviors (e.g., McCook 1888; Muma & Muma 1945; Coyle & Shear 1981; Coyle 1983; Edwards & Edwards 1990; Hardy 2003). The only population-level study we are aware of was conducted over a two-year period in eastern Kansas on populations of *S. niger* and *S. rufipes*. Results were inconclusive, because the populations appeared to suddenly decline. To our knowledge, no other demographic data exist for *Sphodros* species.

Tuckernuck Island, 50 km south of Cape Cod, Massachusetts, consists of 3.3 km^2 of private property located 2.9 km west of the larger island of Nantucket and 14 km east of the even larger island of Martha's Vineyard. The largest mammal is white-tailed deer, and there are no large scavengers or predators, such as raccoons, skunks, or foxes.

In 2006, during an ongoing spider species survey of Tuckernuck Island that included five hours of ground searching, we confirmed the presence of *S. rufipes* in the form of numerous pursewebs in grassy areas of the island. *Sphodros rufipes* has been known locally for many years to occur on Tuckernuck (D. Brown pers. comm.). We excavated specimens (all female) in their webs to confirm species identity as *S. rufipes* rather than *S. niger* (Gertsch & Platnick 1980). During the summer of 2008 we returned to Tuckernuck with the objectives to estimate *S. rufipes* colony density, record web characteristics, and collect prey parts for diet analysis.

We made two trips to the island on 5–8 June and 17–20 August 2008. We counted webs in a 50 × 50 m plot on the western side of the island (southwest corner 41.304558°N, 70.26798°W) and a 37 × 50 m plot on the eastern side (smaller due to time constraints) (southwest corner 41.29922N, 70.24516°W). Each plot encompassed a previously identified aggregation of pursewebs. The western site was located on a western-facing hill covered in grasses and scattered heath shrubs. The eastern site was a flat area with a pitch pine stand (*Pinus rigida*) surrounded by extensive black huckleberry clones (*Gaylussacia baccata*) and patches of grassland. Neither site was near open water. The substrate at both sites was sandy loam. We assigned a coordinate system to each plot and began counting webs starting at the southwest corner designated as (0 m, 0 m) (Fig. 1). Walking up and down the north axis we counted webs within a 1m-wide path, starting a new path to the east. In this way, we zig-zagged through the plot parallel to the east axis. We held a 1m^2 quadrat frame to measure the meter-wide path as we walked, and we used survey flags to mark our previous path and line us up for the next pass through the plot. We recorded the location of each web by measuring its distance along the north and east axes.

In addition to the plots, we used a random searching protocol to assess how likely one is to find more than one web in a given area. After locating a web, we walked in three random directions, each for a random distance between zero and 50 m, and counted the number of webs we encountered. In all web encounters, we assumed that any web that was cylindrical rather than flattened was occupied.

Within and around the eastern and western plots we collected the remains of prey items from 56 webs for diet analysis. These prey remnants consisted of disarticulated sclerotized arthropod parts, usually hanging from silk threads at the top of a web.

Our results suggest that the *S. rufipes* population on Tuckernuck is very large. We counted a total of 479 webs, 146 in the west and 333 in the east (Fig. 1). Dividing by the surveyed area (2,500 m^2 in the west and 1,850 m^2 in the east) gives a density of 0.058 webs/m^2 in the west and 0.18 webs/m^2 in the east. We used APACK 2.23 to calculate aggregation indices for each site (Mladenoff & DeZonia 2004). This software provides both a class-specific aggregation index (AI) and a

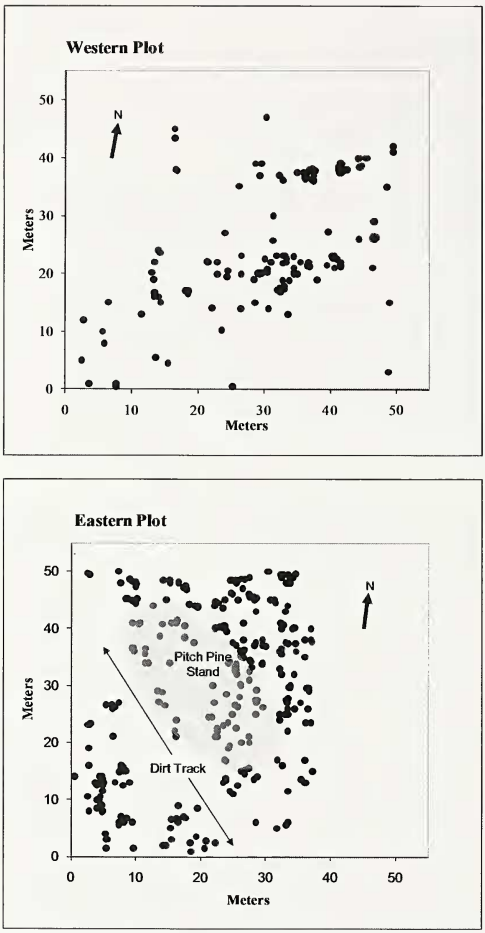

Figure 1.—Spatial distribution of *S. rufipes* webs (dots) plotted to within the nearest decimeter at the sampled western and eastern plots (upper and lower graphs, respectively).

landscape aggregation index (AI_L) with values between zero (disaggregated) and one (completely aggregated) (He et al. 2000). The AI_L represents the level of aggregation for both quadrats that contained webs and those that did not. At 1-m resolution, the web specific AI for the western site is 0.265 and the AI_L is 0.938. The web specific AI for the eastern site is 0.294 and the AI_L is 0.827, also at 1-m resolution. On a landscape level, the webs are fairly aggregated, but the web specific AIs suggest that webs are relatively dispersed.

To our knowledge, the Tuckernuck population occurs in colonies that are denser than other reported populations. For comparison, we compiled web numbers and, when available, the sampled area reported by other researchers. Poteat (1889) studied a population that containcd 0.04 webs/m^2 in North Carolina, while Hardy (2003, pers. comm.) studied one with a density of 0.01 webs/m^2 in Louisiana. Morrow (1986) in Kansas and Tom Chase (pers. comm.) on Martha's Vineyard, Massachusetts, studied populations that appeared to have more than one hundred webs in unmeasured areas. On Tuckernuck, the density at the eastern site (0.18) is more than four times Poteat's (1889) population density and 14 times the density Hardy (2003) describes. Our random search protocol showed that *S. rufipes* are not usually found alone or in isolated groups. We came across 12 additional webs outside the study plots, located in seven groups (each group contained between one and three webs within one m^2) spread across the island. We used our random searching protocol at these seven sites and located an additional 17 webs. We located additional webs at five of the seven groups (71%). Our success at finding more webs after locating one web or a small group of webs, suggests that *S. rufipes* on Tuckernuck occur in groups ranging from small aggregations to large colonies.

Vegetation used for web attachment is unusual on Tuckernuck. At the western plot, 83 percent of the webs were attached to non-woody objects (predominantly Pennsylvania sedge, *Carex pensylvanica*), and 16 percent were attached to a woody shrub. The average aerial web length with standard error was 11 ± 0.36 cm, but the distance from the ground to the top of any one web varied greatly (1–15 cm). In the eastern plot, 51% of the webs were attached to non-woody objects (again, predominantly *C. pensylvanica*), and 41% were attached to a woody shrub (predominantly *Gaylussacia baccata*). One of these webs was attached to a pitch pine (*Pinus rigida*) (25 cm diameter at breast height). This is unusual, for pines are not mentioned as web supports in any other study. Another 8% were attached to other objects such as a dead leaf, a dead log, or dead pine needles. The webs were on average 9.9 ± 0.88 cm long and the height from the ground to the top, again, varied greatly (0.5–15 cm).

There is only one previous report of *S. rufipes* using grass as a web support (Muma & Muma 1945), and most studies describe the spiders using trees. Hardy (2003) reported that *S. rufipes* in his study area used deciduous trees and avoided coniferous trees. Our findings strongly support a view that *S. rufipes* will use whatever support is available, even the rare conifer. Deciduous trees (mostly oaks) exist on Tuckernuck and form a centrally located forest, but in cursory surveys we did not find any webs attached to these trees. Large oaks were not present in our survey plots. Spiders did use the small woody shrub *Gaylussacia baccata*. Coyle & Shear (1981) noted that *S. rufipes* in Florida preferred smaller trees (< 10 cm) to larger ones.

We found prey remnants on 50% of webs (n = 111). Coleopterans and isopods were the most abundant prey items, found on 42% and 38% of the sampled webs, respectively (sampled webs refer to webs that contained prey parts). The most common coleopterans were Scarabaeidae (43% of coleopteran specimens) and Elateridae (17%). We found several other orders represented on only a few webs, including Diploda (1.8% of webs), Opiliones (3.6%), Araneae (7.1%), and Hymenoptera (14%). Our data are similar to those of Coyle & Shear (1981) and Muma & Muma (1945), who also collected prey parts from *S. rufipes* webs.

A possible explanation for the high densities we observed on Tuckernuck is low predation rates. We did not find evidence of any predation, and there are no mammal scavengers on the island. However, predation on *S. rufipes* webs has been observed on Block Island, R.I. in late March (E. Edwards, pers. comm.). Edwards found webs pulled up and dug out of the ground, probably by ring-necked pheasants. To our knowledge, there are no pheasants on Tuckernuck.

ACKNOWLEDGMENTS

This project was funded by a grant from the Nantucket Biodiversity Initiative, and equipment and logistical support was provided by the Nantucket Maria Mitchell Association. We would like to thank the Tuckernuck residents and the Tuckernuck Land Trust (TLT) for allowing us access to private property and the TLT

field station. We are indebted to the late R.L. Edwards and to E.H. Edwards for pointing us toward this work and commenting on the manuscript. L.M. Hardy and J. Goyette also provided helpful comments that greatly improved this manuscript. R. Kennedy lent us his boat to travel to Tuckernuck.

LITERATURE CITED

Coyle, F.A. 1983. Aerial dispersal by mygalomorph spiderlings (Araneae, Mygalomorphae). Journal of Arachnology 11:283–286.

Coyle, F.A. & W.A. Shear. 1981. Observations on the natural history of *Sphodros abboti* and *Sphodros rufipes* (Araneae, Atypidae), with evidence for a contact sex pheromone. Journal of Arachnology 9:317–326.

Edwards, R.L. & E.H. Edwards. 1990. Observations on the natural history of a New England population of *Sphodros niger* (Araneae, Atypidae). Journal of Arachnology 18:29–34.

Gertsch, W.J. & N.I. Platnick. 1980. A revision of the American spiders of the family Atypidae (Araneae, Mygalomorphae). American Museum Novitates No. 2704:1–39.

Hardy, L.M. 2003. Trees used for tube support by *Sphodros rufipes* (Latreille 1829) (Araneae, Atypidae) in northwestern Louisiana. Journal of Arachnology 31:437–440.

He, H.S., B.E. DeZonia & D.J. Mladenoff. 2000. An aggregation index (AI) to quantify spatial patterns of landscapes. Landscape Ecology 15:591–601.

McCook, H.C. 1888. Nesting habits of the American purseweb spider. Proceedings of the Academy of Natural Sciences of Philadelphia 40:203–220.

Mladenoff, D.J. & B. DeZonia. 2004. APACK 2.23 User's Guide. Department of Forest Ecology and Management, University of Wisconsin-Madison, Madison, Wisconsin.

Morrow, W. 1986. A range extension of the purseweb spider *Sphodros rufipes* in eastern Kansas (Araneae, Atypidae). Journal of Arachnology 14:119–121.

Muma, M.H. & K.E. Muma. 1945. Biological notes on *Atypus bicolor* Lucas (Arachnida). Entomological News 56:122–126.

Poteat, W.L. 1889. A tube-building spider. Journal of the Elisha Mitchell Scientific Society 6:134–147.

Manuscript received 5 March 2010, revised 25 October 2010.